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A REVIEW OF THE *PHYLLOPHAGA IGNAVA* SPECIES GROUP WITH DESCRIPTIONS OF TWO NEW SPECIES FROM TEXAS (COLEOPTERA: SCARABAEIDAE; MELOLONTHINAE)

Edward G. Riley and Charles S. Wolfe
Department of Entomology, Texas A&M University, College Station, Texas 77843
Department of Biology, University of Texas at Arlington, Arlington, Texas 76019

Abstract.—The composition and characterization of the *ignava* species group of *Phyllophaga* (*s. str.*) are reviewed, and two new species belonging to this group, *P. invisa* and *P. rolstoni,* are described from Texas. Genitalia are illustrated for each new species and enface views of the parameres are given for *P. ignava* (Horn) and *P. idonea* Sanderson, two previously described members of the group. The range, habitat, and flight periods in Texas are presented for each species belonging to the group. A lectotype is designated for *P. ignava.*

This work is the first of a planned series of papers on the species of *Phyllophaga* occurring in Texas in which we will address taxonomic problems, including the descriptions of new species, and present new distributional and biological data. The species group which includes *Phyllophaga ignava* (Horn) as its first-described member is treated here.

Two modern (post-Horn, 1887) concepts have been proposed for the *ignava* species group of *Phyllophaga s. str.* Sanderson (1958) provided a morphological definition for the group in a key to Arizona species groups. His concept was broad and included species which possessed either a fixed or free lower spur on the male hind tibia and diverse forms of the parameres. Morón (1986) restricted the definition by removing three of the species included by Sanderson: *P. fucata* (Horn), *P. lobata* (Fall) and *P. opaca* (Moser). Morón included only two species in the group: *P. ignava* and *P. saylori* Sanderson. The latter was described from Nuevo Leon, Mexico (Sanderson, 1965). Morón's narrower concept for the *ignava* group is followed here; however, the following characters support the removal of *P. saylori* from the *ignava* species group: the short antennal club of the male, the shape of the male abdomen in lateral view, the dorsally asymmetrical parameral base, the narrow and widely divergent parameres, and the heavily sclerotized aedeagus which possesses articulated armature. From study of the original description, we believe *P. saylori* is best placed in the *schizorhina* species group, although the dorsal margin of the parameral base is asymmetrical, not symmetrical as in the other members of that group (Morón, 1986).

Four species are recognized in the *ignava* species group: *P. ignava* (Horn), *P. idonea* Sanderson, and the two new species described herein.

PHYLLOPHAGA S. STR., GROUP IGNAVA

Diagnosis: Parallel-sided, reddish-brown, dorsally glabrous. Antennae 10-segmented, male club long, about as long as funicle and scape combined; female club short, about as long as funicle. Abdomen with very weakly expressed sexual dimorphism;

moderately swollen in lateral view, slightly more so in female; visible sternum 5 very short, anterior edge impressed to level below posterior margin of sternum 4. Both hind tibial spurs of male free, upper spur long and narrow, nearly as long as or (usually) slightly longer than first hind tarsal segment. All pairs of claws symmetrical, each claw weakly curved with a moderate-sized, submedian tooth; base of claw rounded. Male genitalia symmetrical, parameres elongate-tubiform, with median ventral area membranous. Aedeagus with little sclerotization, inornate; aedeagal apodemes separate proximally, fused more or less by varying degrees of sclerotization along midlength, fused dorsally but not ventrally at apex. Internal sac of aedeagus tubiform, more or less symmetrical, swollen distally with broad band of microspines encircling base of swollen area. Female with weakly sclerotized superior and inferior plates, pubic process absent.

KEY TO SPECIES OF THE *PHYLLOPHAGA IGNAVA* SPECIES GROUP

1. Fringe setae of elytra inconspicuous, hidden from dorsal view; body larger, length 16.6–21.1 mm; parameres with apices narrowly separated enclosing a single ovoid distal opening (Fig. 1) . . . . *invisa* n. sp.
   Fringe setae of elytra conspicuous, those below humeral umbone long and easily seen from dorsal view; parameres variable 2
2. Parameral base with broad proximally-directed lobes below (figs. 7, 9), apices of parameres widely separated not enclosing the distal opening (fig. 4); body smaller, length 13.1–15.7 mm . . . . *rolstoni* n. sp.
   Parameral base unmodified below, apices of parameres narrowly separated enclosing a distal opening; body generally larger, length 14.5 to 18.0 mm 3
3. Distal opening of parameres singular, oval in shape (fig. 2); internal sac without sclerotized armature . . . . *ignava* (Horn)
   Distal opening of parameres doubled, figure eight-shaped (fig. 3); internal sac armed with a large, recurved, tooth-like process . . . . *idonea* Sanderson

Phyllophaga (*s. str.*) *ignava* (Horn)
(Fig. 2)

Lachnosterna ignava Horn, 1887:280.
Phyllophaga ignava: Glasgow, 1916:74.

Some confusion regarding the application of this name was fostered with the publication of the male genitalia photographs by Luginbill and Painter (1953, plate 51, figs. 8, 9; pl. 56, figs. 10, 11). Of these figures, those where the double or figure eight-shaped distal opening of the parameres can be seen (plate 51, fig. 8 and plate 56, figs. 10, 11) are not *P. ignava* but *P. idonea.* This structure of the parameres is unique to *P. idonea* and was illustrated by Sanderson (1948) as part of the original description. Through an apparent oversight, Luginbill and Painter did not treat either *P. idonea* or *P. gaigei* Sanderson which was described in the same paper. The first published illustration of the male genitalia of *P. ignava* is found in Smith (1889, plate 60, fig. 77) and shows a single, round distal opening matching that of the specimen which is here designated as the lectotype (see below).

Range: Regarding *P. ignava,* Luginbill and Painter (1953) state that it is a rare species occuring from Arizona to southwestern Texas. The occurrence of *P. ignava* in Arizona has not been confirmed by us. William Warner and Scott McCleve, who

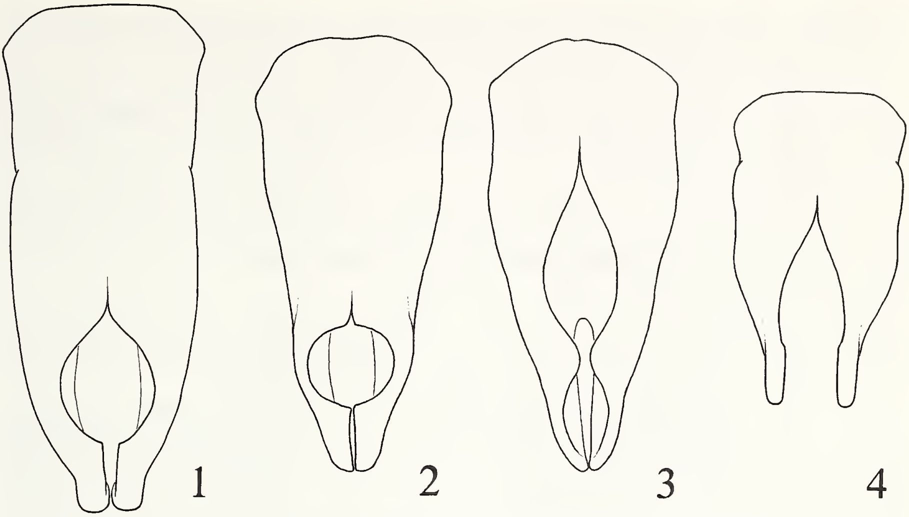


Fig. 1–4. En-face view of parameres of species of the *ignava* group. 1, *P. invisa* n. sp. 2, *P. ignava* (Horn). 3, *P. idonea* Sanderson. 4, *P. rolstoni* n. sp.

have collected extensively in Arizona, have not taken *P. ignava* in that state (personal communications, 1992). In addition, William Warner has examined many specimens from Arizona identified as *P. ignava* in various collections and has found that all are *P. idonea* (personal communication, 1992). All material we have seen from Arizona represents *P. idonea,* and we believe the Arizona records of *P. ignava* in Butler and Werner (1961), the record and larval description in Rosander and Werner (1970), and Sanderson's (1958) reference to *P. ignava* in Arizona, are probably misidentifications of *P. idonea.*

We have found *P. ignava* to be one of the most commonly taken *Phyllophaga* along the southern border of Texas. Its range extends northward to Central Texas. Reinhard (1950) reported it from Johnson County (near Fort Worth, Texas). In addition to material from Texas, we have seen specimens from southeastern New Mexico and the Mexican states of Chihuahua, Coahuila and Durango.

Habitat: In Texas, *P. ignava* occurs in sabal palm groves (Brownsville area), south Texas brushlands, xeric areas and montane oak-juniper and oak-pine-juniper associations. The elevational range is from near sea level at Brownsville, to at least 5,800 ft (ca. 1,770 m) in the Davis Mountains, and to at least 5,500 ft (ca. 1,680 m) in the Chisos Mountains. It coexists with *P. idonea* in the Chisos Mountains (Sanderson, 1948).

Type specimens: Horn (1887) gave the following distributional data for the type material: "occurs in Texas and New Mexico (Prof. Snow)." We have examined the syntype series of four specimens in the Horn Collection (MCZ). Data on labels and attachments to the specimens' pins are given below separated by slashes; attachments and our comments are enclosed in brackets.

The first specimen is a male: Tex [printed]/♂ [printed]/L. ignava Horn [handwritten]/TYPE No. 3688 Lachnosterna ignava G. H. Horn [printed and hand-written on red]/G. H. Horn Collection [printed]/[microvial containing male genitalia]/lectotype Lachnosterna ignava Horn, desig. Riley & Wolfe, 1992 [printed on red].

The second specimen is a female: Tex [printed]/[an illegible, hand-written name which could be read as "Fuller"]/[cork stub with female genitalic plates affixed]/[small square of red paper]/Para-Type 3688.2 [printed and hand-written on green]/G. H. Horn Collection [printed].

The third specimen is a male: New Mexico F. H. Snow [printed]/♂[printed]/Para-Type 3688.3 [printed and hand-written on green]/G. H. Horn Collection [printed]/[microvial containing male genitalia]/Phyllophaga idonea Sanderson, Det. Riley & Wolfe, 1992 [printed on white].

The fourth specimen is a male: New Mexico F. H. Snow [printed]/Para-Type 3688.4 [printed and hand-written on green]/Phyllophaga ignava (Horn) 13555 Det. A. A. Granovsky 1939 [printed]/G. H. Horn Collection [printed].

The "type" and "paratype" labels attached to the pins of the above specimens are of no nomenclatorial significance because Horn did not designate type specimens and a previous lectotype designation has not been published for *P. ignava.* To eliminate the potential for future confusion and to fix the usage of the name *ignava* consistent with the concept held by Sanderson (1948), the first and previously dissected syntype is hereby designated as lectotype. Upon dissection, the third syntype was determined to be P. idonea Sanderson. It was discovered that the abdomen of the fourth syntype had been previously removed and the genitalia were missing. This specimen, as well as the female specimen, are not designated as paralectotypes because their identity could not be determined.

Locality records: (Fig. 13) Given below are the localities from specimens of *P. ignava* which we have examined. Identifications were confirmed by dissection of at least one male from each series.

UNITED STATES: NEW MEXICO: *Eddy Co.,* Sitting Bull Canyon; Guadalupe Mts., Dark Canyon, 6,200 ft. *Otero Co.,* Dry Canyon E of Alamogordo, 6,000 ft. TEXAS: *Atascosa Co.,* 5 mi W Campbellton. *Bandera Co.,* Lost Maples St. Pk. *Bexar Co.,* San Antonio, Friedrich Park. *Brewster Co.,* Alpine; Big Bend Natl. Pk., Green Gulch; BBNP, The Basin; BBNP, Maple Cyn., 5,200′; BBNP, Grapevine Hills Campgrd., 29°24′N; 103°11′W; BBNP, North Rosillos Mts., Buttrill Spring; Stillwell RV Park. *Burnet Co.,* Inks Lake St. Pk. *Cameron Co.,* Sabal Palm Grove. *Comal Co.,* nr. Boerne; 12 mi. N New Braunfels. *Crockett Co.,* Pecos River at hwy. 239. *Culberson Co.,* Guadalupe Peak Natl. Pk., Pine Springs. *Duval Co.,* 3 mi S. Freer. *El Paso Co.,* Hueco Tanks St. Pk. *Frio Co.,* 16 mi W Dilley. *Hidalgo Co.,* Bentsen-Rio Grande Valley St. Pk. *Jeff Davis Co.,* Davis Mts. St. Pk.; Fort Davis; 1 mi W, 4 mi W, 11 mi W & 28 mi W Fort Davis; Davis Mts. Resort, 5,800′ (D. Marqua residence). *Kerr Co.,* Double L. Ranch, 6 mi N Kerrville; Kerrville; Kerrville-Schreiner St. Pk. *Kimble Co.,* South Llano Riv. St. Pk. *Menard Co.,* Menard. *Presidio Co.,* Big Bend Ranch St. Nat. Ar., Madera (Monilla) Cyn. Riv. Acc.; BBRSNA, Colorado Cyn. Riv. Acc.; Fort Leaton St. Hist. Site; 12.5 mi W Lajitas; Presidio; Redford. *San Patricio Co.,* Lake Corpus Christi St. Pk. *Sutton Co.,* Sonora. *Terrell Co.,* Jct. Independence Ck. & hwy. 349. *Tom Green Co.,* Christoval. *Uvalde Co.,* 65 Km W Uvalde. *Val Verde Co.,* Dolan Creek Campgrd., 29°54′N: 100°53′W; Rio Grande at Langtry; Seminole Canyon St. Pk.

MEXICO: CHIHUAHUA: hwy. 49, 21 mi SE Cd. Jimenez, 1.6 NE on m-wave rd., 4,720 ft; hwy 45, 23 mi SW Cd. Jimenez, 5,050 ft COAHUILA: Carrizo Wash, 25 mi W Muzquiz; Burro Mt., San Esteban. DURANGO: hwy. 45, 5 mi N Rodeo, 6 mi W, 4,980 ft.
Flight period in Texas (collections per month): April (6), May (7), June (26), July (12), August (9), September (2).

Phyllophaga (*s. str.*) *idonea* Sanderson
(Fig. 3)

Phyllophaga idonea Sanderson, 1948:1.

The confusion surrounding the identification of this species and *P. ignava* is discussed above under *P. ignava.* The characters distinguishing *P. idonea* from the two new species, *P. invisa* n. sp. and *P. rolstoni* n. sp., are discussed under those species. From *P. ignava,* it differs in the shape of the parameres, specifically by the double or figure eight-shaped distal opening (fig. 3), instead of a simple, round to ovoid opening, and by having sclerotized armature on the internal sac of the aedeagus. *Phyllophaga idonea* is the only member of the *ignava* group which possesses armature on the internal sac other than the broad band of microspines common to all species of the group. This armature consists of a single recurved, tooth-like structure positioned on a sclerotized plate on the dorsal side of the internal sac.
Range: Texas (Chisos Mts.), New Mexico and Arizona. Thus far, *P. idonea* has not been taken in Texas outside the Chisos Mts., but it is confirmed for New Mexico and several locations in Arizona (see below). It was not recorded from Mexico (Morón, 1986), although we expect it to occur in northern Mexico in environs similar to the Chisos Mts.
Habitat: Oak-pine-juniper associations at elevations from 5,000 to 6,500 ft (ca. 1,500 to 2,000 m) in the Chisos Mountains. It coexists with *P. ignava* at the type locality, Juniper Canyon, Chisos Mts. (Sanderson, 1948). Butler and Werner (1961) list as hosts for *P. ignava* (which we believe is a misidentification of *P. idonea*), *Quercus gambelii* Nutt., *Q. oblongifolia* Torr. and *Q. turbinella* Greene. William Warner has associated *P. idonea* with *Q. turbinella* in Arizona, but has not observed feeding (personal communication, 1992).
Locality records: (Fig. 13) Given below are the localities from specimens of *P. idonea* which we have examined. Identifications were confirmed by examination of male genitalia.
ARIZONA: *Gila Co.,* Sierra Ancha Mts., Parker Cyn.; Sierra Ancha Mts., Workman Creek. *Graham Co.,* Gailuro Mts., High Creek, 1660 m. *Maricopa Co.,* Jct. Fish Ck. Cyn. & Apache Trail; Seven Springs Campground; Sunflower, Sycamore Ck., 1200 m. *Pima Co.,* Mt. Lemmon (lower edge of oak zone). *Pinal Co.,* Devil's Cyn. & US Hwy. 60. *Yavapai Co.* Hassayampa Riv., 5,040 ft. NEW MEXICO: no further data. TEXAS: *Brewster Co.* Chisos Mts., Juniper Canyon (paratypes); Chisos Mts., Pine Canyon, 6,500 ft.
Flight period in Texas (collections per month): June (1), July (2).

Phyllophaga (*s. str.*) *invisa* **n. sp.**
(Figs. 1, 5, 6, 10)

General: Oblong-elongate, sides parallel; length/width = 2.0–2.1; Length, males 16.6–19.0 mm; females 17.3–21.1 mm. (for length variation, see fig. 12). Maximum width, males 7.7–9.2 mm; females, 8.6–9.9 mm. Dorsum glabrous, glossy; coloration distinctly two-tone: head and pronotum dark reddish brown, elytra light to medium reddish brown, distinctly lighter than head and pronotum. Venter, including legs, dark reddish brown, abdominal sterna a slightly lighter shade of reddish brown. **Head:** Clypeal margin narrowly reflexed throughout, weakly emarginate medially; surface little impressed behind margin, evenly punctate; punctures ovate, simple and closely spaced, separated on average by distance less than maximum diameter. Frontoclypeal suture distinct throughout length, not interrupted by punctation, sinuate. Punctation of frons similar to that of clypeus, ending abruptly on vertex, at least medially, leaving a smooth, impunctate band across base of head (visible in repose), at least a few punctures present laterally in this area near eyes. Head width/interocular distance = 1.5 to 1.7 in males, 1.5 to 1.6 in females. Antenna 10-segmented; male club length/funicle length = 2.0 to 2.4; female club distinctly shorter than male, female club length/funicle length = 1.1 to 1.2. **Pronotum:** 1.5 to 1.7 times as wide as long; anterior margin nearly straight from side to side with distinct, elevated, flat marginal bead which is crenate internally; posterior margin faintly arcuate, margined and with a line of closely placed punctures. Lateral margin broadly rounded at midlength, tapering and weakly sinuate before anterior and posterior angles, more strongly so posteriorly; bead distinct, interrupted by crenations which are graded from strong and distant anteriorly to fine and closely spaced posteriorly; marginal setae few, small and inconspicuous. Anterior angle obtuse, not projected; posterior angle acute, weakly projected. Disc evenly convex from side to side, vaguely flattened in anterolateral region, rather abruptly declivous before posterolateral margin; punctation more or less evenly spaced, less dense just before lateral and hind margins, punctures along anterior margin and on anterolateral area a little more crowded and slightly smaller than those on mesal region. Punctures round, subequal to or slightly larger than those on frons, each seated within shallow impression, intervening areas weakly convex. **Scutellum:** Sparsely punctate, punctures slightly smaller than those on pronotum, placed irregularly but most frequent along basal and lateral margins. **Elytron:** Broad, sutural costa distinct, other costae obscure; lateral margin with fringe setae small and inconspicuous, hidden anteriorly from dorsal view by umbone. Punctation on disc more or less regularly spaced; punctures slightly smaller than those of pronotal disc, each seated within vague impression as on pronotum, separated on average by spaces approximately twice their diameter. **Venter:** Metasternum and hind coxal plate rather closely and uniformly punctate; pubescence of metasternum moderately long, sparse. **Legs:** Lower spur of hind tibia articulated in both sexes; both spurs of male narrow, weakly curved, apices narrowly rounded; upper spur longer than first tarsal segment, first tarsal segment length (FTSL)/upper spur length (USL) = .73 to .89; lower spur shorter than first tarsal segment, FTSL/lower spur length (LSL) = 1.25 to 1.6. Hind tibial spurs of female as in male except slightly broader, upper spur longer than first tarsal segment, FTSL/USL = .71 to .74; lower spur equal in length to first tarsal segment. Tarsal claws weakly curved in male, a trifle more strongly curved in female; tooth moderate in size, positioned slightly before the middle of claw. **Abdomen:** Similar between males and females; mesal region of visible sterna 2–5 of male very slightly flattened; sternum 6 short, unmodified. **Genitalia:** male (Figs. 5, 6): symmetrical; ventral surface of base simple, without elevated lobes. Parameres narrowed distally, apices narrowly separated in en-face view; distal opening single, ovoid, drawn-out proximally to narrow point. Apex of paramere in lateral view simple and narrow, evenly curved ventrad. Aedeagus membranous except for sclerotized pair of subparallel apodemes which are fused distally. Internal sac simple, without sclerotized armature, narrow proximally and distinctly swollen distally; a broad band of microspines encircling most of swollen area and part of narrow portion of sac. Female (Fig. 10): major setae on apical portions of superior and inferior plates less numerous and shorter than seen in other species of the group.

Holotype: TEXAS: Kenedy Co., 5 mi. S Sarita, VI-15-1990, C. S. Wolfe, collected at UV light. A male with genitalia contained in a glycerine-filled microvial, aedeagus and internal sac distended. Deposited in the Texas A&M University Collection [TAMU].

Allotype: Same data as above. A female with genitalic plates in glycerine-filled microvial, deposited in TAMU.

Paratypes: (430 total), deposited at American Museum of Natural History, California Academy of Sciences, Canadian Museum of Nature, Florida State Collections of Arthropods, Illinois Natural History Survey, Museum of Comparative Zoology, Louisiana State University, Texas A&M University, United States National Museum of Natural History, and several private collections.

TEXAS: *Aransas Co.,* Goose Island St. Pk., VI-7-1983, D. A. Rider & C. B. Barr [8♂♂, 1♀]; Rockport, VIII-10-1985, S. J. Hanselman, at street lights [1♀]. *Atascosa Co.,* 12 mi S Lytle, V-26-1994, Wm. Godwin & R. Gibson, BL [11♂♂, 4♀♀]; Pleasanton, VI-15-1985, D. W. Sundberg [1♂, 1♀]. *Bastrop Co.,* Bastrop, VII-2-1978, O. E. Hunt [1♂]; 6 mi E Bastrop, VII-13-1985, D. W. Sundberg [1♂, 1♀]; Bastrop St. Pk., VII-7-1989, E. G. Riley [10♂♂]; VII-21-1989, E. G. Riley & C. S. Wolfe, UV light [4♂♂]; VI-20-1990, MV & BL light [14♂♂]; VII-17-1991, C. S. Wolfe, UV light [2♂♂]; VI-25-1990, E. G. Riley, S. Lingafelter & R. Vogtsberger, at UV light [5♂♂]. *Bexar Co.,* I-37 2 mi S Jct. 1604, VIII-19-1988, D. W. Sundberg, blacklight [12♂♂, 1♀]; I-37 & Mathis rd., Waterwood Estates, VII-2-1988, D. W. Sundberg [5♂♂]; V-1991, D. W. Sundberg [15♂♂]; Mathis, VI-4-1988, D. Sundberg [3♂♂, 2♀♀]. *Brooks Co.,* rest stop, 7.3 mi S Falfurrias on hwy. 281, V-8-1989, E. G. Riley, at light [1♂]; V-4-1989, C. S. Wolfe, at lights [1♂]; V-25-1989 [3♂♂, 1♀]; V-13-1990 [4♂♂, 1♀]; VI-13-1990 [17♂♂, 6♀♀]; VII-18-1991 [23♂♂, 7♀♀]; IX-5-1992 [1♂, 4♀♀]; 8 mi. S Falfurrias, IX-12-1987, E. G. Riley, at lights [10♂♂, 13♀♀]; IX-2-1989, D. J. Heffern, lights [1♂]; VIII-7-1992, [2♂♂]; IX-19-1992, D. B. Thomas [2♂♂, 1♀]. *Caldwell Co.,* ca. 5 mi E McMahan, VI-3-1994, Wm. Godwin [1♂]. *Kenedy Co.,* 5 mi S. Sarita, VI-13-1990, C. S. Wolfe, collected at UV light [holotype & allotype, 17♂♂, 11♀♀]; VI-15-1990 [5♂♂, 1♀]; 6.2 mi S. Sarita, V-2-1991, C. S. Wolfe, UV light [1♂]; V-20-1991 [5♂♂, 1♀]; VI-19-1992, [16♂♂, 6♀♀]; IX-6-1992 [3♂♂, 2♀♀]. *Kleberg Co.,* Padre Island (North), outside Natl. Pk. gate, VIII-27-1988, D. W. Sundberg, blacklight [10♂♂, 1♀]; North Padre Island, VI-20-1992, C. S. Wolfe, UV light [64♂♂, 25♀♀]. *Leon Co.* 5 mi N Flynn, VII-

11-1993, E. G. Riley, UV light [5♂♂]; VII-16-1993, H. & A. Howden [2♂♂]. *Medina Co.,* Devine, VI-12-1975 [1♂]. *Milam Co.,* Sugar Loaf Mt., 4 mi N Gause, 500′, VII-21-1992, Godwin & Gibson, BL [2♂♂, 1♀]; VII-22-1992, Godwin & Riley, MV & BL [12♂♂, 1♀]; same locality, except 350′, VII-30-1992, Wm. Godwin, BL [23♂♂]. *San Patricio Co.,* Welder Wdlf. Ref., 17 km NE Sinton, V-17-25-1985, H. & A. Howden, C. Scholtz, on Sesbania drummondii, blacklight, dung-carrion traps [5♂♂, 4♀♀]; Welder Wdlf. Ref. VII-18-1988, J. C. Schaffner [1♂]; WWR, hackberry woodland, VI-19-1989, J. M. Mora, pit-fall trap [1♂]. *Starr Co.,* La Gloria, IX-26-1992, D. B. Thomas [1♀].

Etymology: From the Latin *invisus,* meaning unseen.

Comparative remarks: This is the only species of the *ignava* species group which can be confidently determined by external characters. It is separated from the other species of the group by its larger size (see Fig. 12), two-tone dorsal coloration, and the small and inconspicuous fringe setae of the elytra, particularly those below the umbone which are small enough to be completely hidden from dorsal view. In the two previously described species and *P. rolstoni* n. sp., the average body length is smaller, dorsal coloration is nearly one continuous red-brown tone, and the fringe setae of the elytra are long and conspicuous, especially those below the umbone. The shape of the distal opening of the male genitalia of *P. invisa* differs slightly from that of *P. ignava* (see Figs. 1, 2).

Range: (Fig. 13) Confined to south and east-central Texas where it occupies the easternmost portion of the range of the *ignava* species group. The easternmost localities are in Leon County in the north, and Aransas County on the Gulf coast. It is known from as far south as the northern portion of Starr County, but it does not reach the delta of the lower Rio Grande valley. The westernmost locality is in Medina County. The ranges of *P. invisa* and *P. ignava* appear to narrowly overlap in a zone to the south and southeast of Bexar County. Localities where both species coexist are not presently known.

Habitat: *P. invisa* occurs most abundantly, and perhaps exclusively, in areas with very sandy soils. At the southern localities in Kenedy and Brooks Counties, it is associated with the introgressed hybrid oak, *Quercus fusiformis* Small X *Q. oleoides* Cham. & Schlecht., but we have not observed it feeding on this oak or on any other plant species. It has been taken twice in large numbers at treeless areas on North Padre Island in Kleberg County. Localities to the north are also sandy but with dense, mixed oak-pine forest (Bastrop County) or primarily oak (Milam Co.). The elevational range for *P. invisa* is from near sea level to approximately 650 ft. (ca. 200 m) at Devine, Medina Co.

Flight period (collections per month): May (9), June (13), July (13), August (4), September (6).

Phyllophaga (s. str.) rolstoni n. sp.

(Figs. 4, 7–9, 11)

General: Oblong-elongate, sides parallel; length/width = 2.1; Length, males 13.1–15.7 mm; female 14.8 mm. (for length variation, see Fig. 12). Maximum width, male 6.1–7.2 mm; female 7.2 mm. Dorsum glabrous, glossy; dorsal coloration uniform, medium reddish brown. Venter and legs reddish brown, metathorax and abdominal

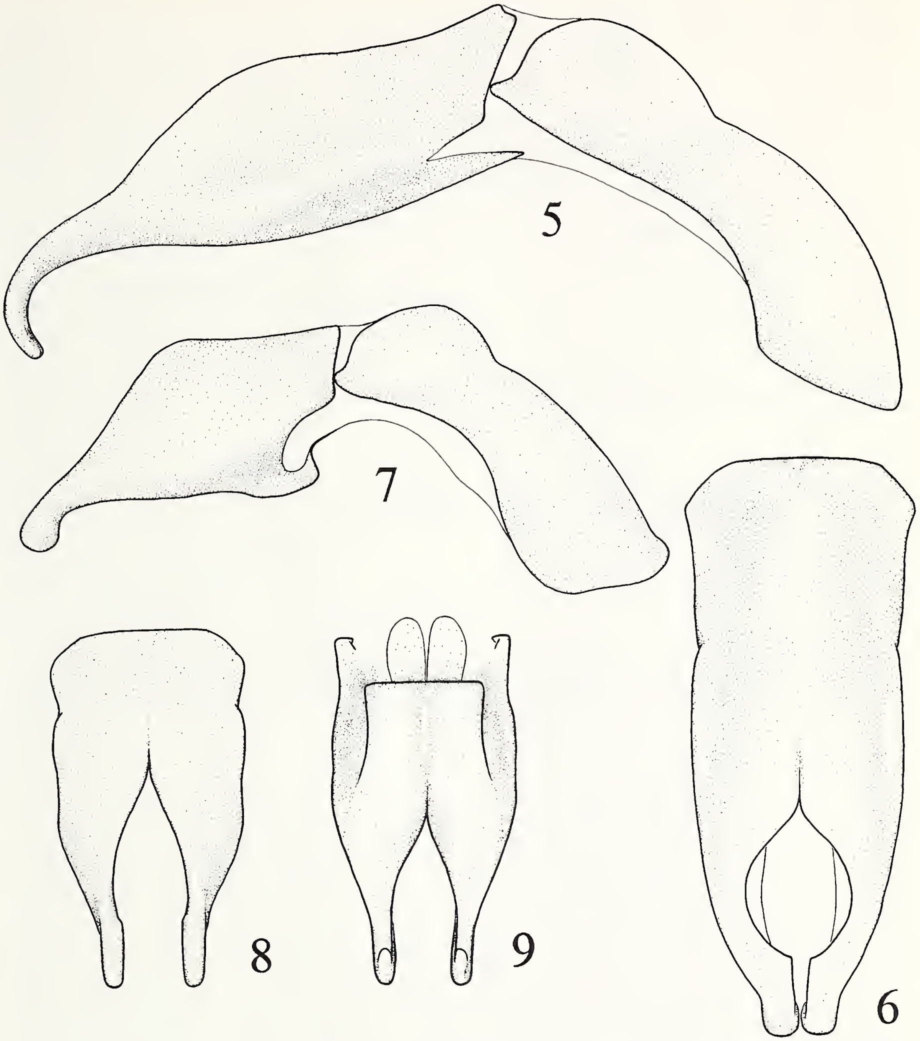
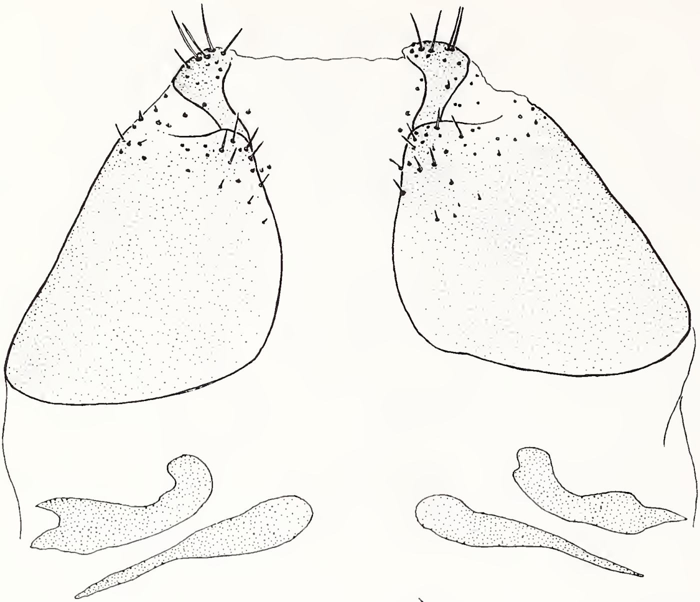


Fig. 5–9. Parameres and basal piece of *Phyllophaga* n. spp. 5, 6, *P. invisa* n. sp., en-face and lateral. 7–9, *P. rolstoni* n. sp., en-face, lateral and ventral.

sterna a lighter shade of reddish brown. **Head:** not differing appreciably from description of *P. invisa,* except punctation on clypeus and frons slightly more dense. Head width/interocular distance = 1.7 to 1.8 in males; 1.5 in female. Antenna 10-segmented; male club equal to 1.6 to 1.8 times length funicle; female club distinctly shorter than in male, equal to 1.1 times length of funicle. **Pronotum:** 1.6 times as wide as long, punctures somewhat less dense and less deeply impressed, otherwise not differing appreciably from description of *P. invisa.* **Scutellum** and **Elytra:** as described for *P. invisa* except marginal fringe setae long and distinct, easily viewed



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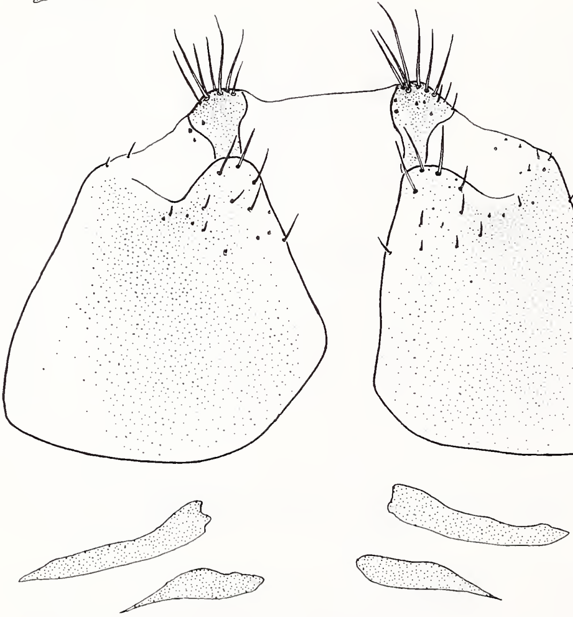

11

Figs. 10, 11. Female genitalic plates, ventral view. 10, *Phyllophaga invisa* n. sp. 11, *Phyllophaga rolstoni* n. sp. Drawn from slide-mounted specimens, many small setae and sensilla not shown. Degree of stippling indicates degree of pigmentation.

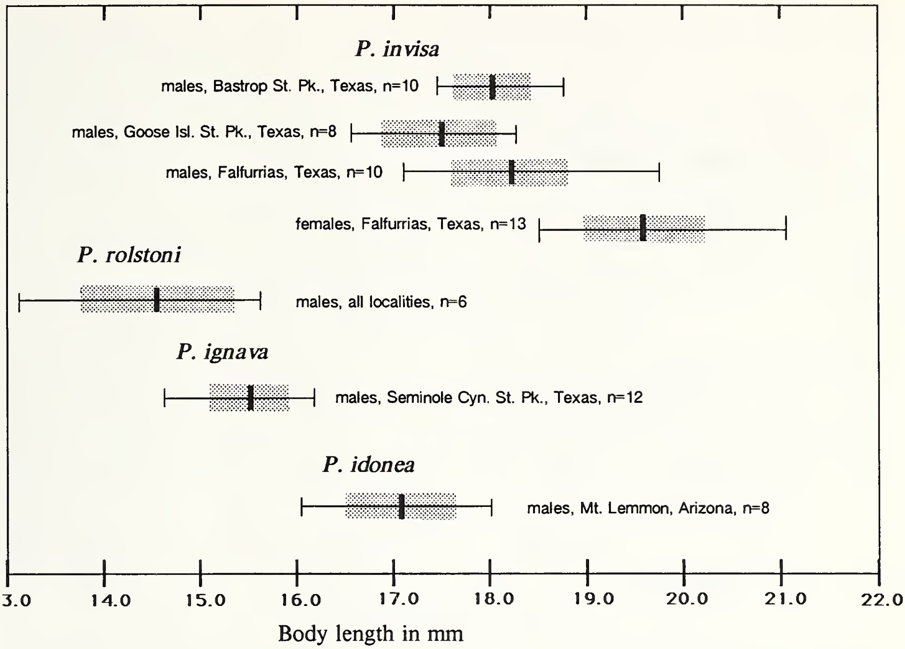

Fig. 12. Body length variation in species of the *ignava* species group. Horizontal line = range, vertical bar = mean, shaded rectangle = ± one standard deviation.

from above, those below umbone longest. **Venter** and **abdomen:** as described for *P. invisa.* **Legs:** Lower spur of hind tibia articulated in both sexes; spurs of male narrow, weakly curved, apices narrowly rounded; upper spur subequal in length to first tarsal segment, first tarsal segment length (FTSL)/upper spur length (USL) = 0.95 to 1.1; lower spur shorter than first tarsal segment, FTSL/lower spur length (LSL) = 1.43 to 1.83. Female with upper spur slightly longer than first tarsal segment, FTSL/USL = 0.9; lower spur shorter than first tarsal segment, FTSL/LSL = 1.27. Tarsal claws weakly curved in male, a trifle more strongly curved in female; tooth moderate in size, positioned slightly before the middle of claw. **Genitalia:** male (Figs. 7–9): symmetrical; ventral surface of base with pair of broad, proximally-directed lobes, apex of each lobe truncate with rounded external angle; each lobe undercut by intrusion of ventral membrane; a pair of broad, sclerotized plates extend proximad into ventral membrane from proximal margin of lobes. Parameres strongly narrowed distally, apices widely separated in en-face view; distal opening elongate oval, drawn-out proximally into long, narrow point, very weakly constricted preapically and remaining broadly open distally. Apex of paramere in lateral view narrow, deflexed ventrally to form a short, rounded lobe. Aedeagus lacking sclerotization except for pair of subparallel apodemes which are joined by weakly sclerotized strip for most of their length, bifurcate and weakly divergent distally. Internal sac of aedeagus elongate-tubiform, fairly uniform in width except a little more swollen

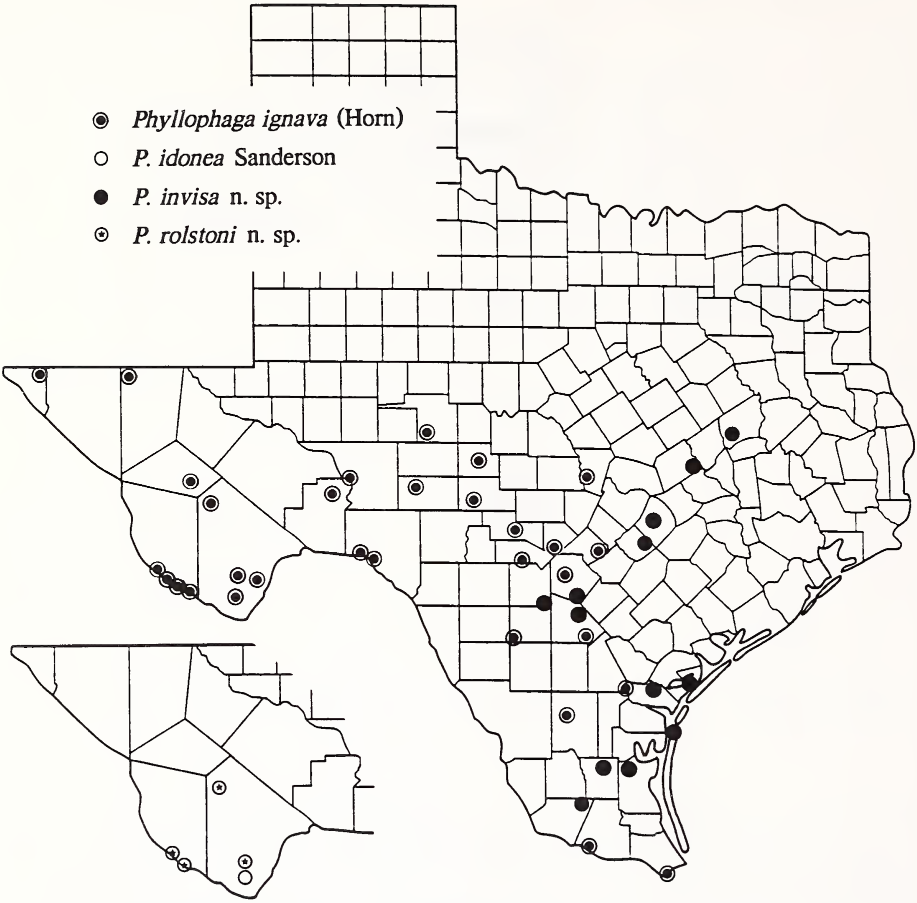

Fig. 13. Distribution records for species of the *ignava* species group. Each symbol represents one locality or more than one approximate localities from which the authors have seen specimens. Only Texas localities shown for *P. ignava.*

apically, without sclerotized armature; distal portion encircled with broad band of microspines. Female (Fig. 11).

Holotype: TEXAS: Presidio Co., Big Bend Ranch State Natural Area, Madera (Monilla) Canyon River Access, VI-5-1992, E. Riley & W. Godwin, UV light. A male with genitalia in glycerine-filled microvial, aedeagus and internal sac distended. Deposited in TAMU.

Allotype: TEXAS: Presidio Co., Big Bend Ranch State Natural Area, Colorado Canyon River Access, VI-10-1992, C. S. Wolfe, at blacklight. A female with genitalic plates in glycerine-filled microvial, deposited in TAMU.

Paratypes: (6 total) deposited in collections of TAMU, Sul Ross State University, Riley, Warner and Wolfe.

Same locality as allotype, VI-5-6-1992, E. Riley & C. Wolfe, UV light [3♂♂];

TEXAS: *Brewster Co.,* Alpine, NE of Sul Ross Sci. Bldg., close to greenhouse #12, 06-05-81 [1♂]; Alpine, Dorm, 06-05-88, Mark Lockwood [1♀]; Rosillos Mts., Buttrill Spring, VII-30-1987, D. J. Heffern, UV light [1♂].

Etymology: This species is dedicated to Lawrence Rolston who served as the first author's graduate advisor and suggested study of *Phyllophaga* as a thesis topic.

Comparative remarks: On average, *P. rolstoni* is the smallest member of the *ignava* species group (see fig. 12). It is easily separated from *P. invisa* by external characters (see discussion above), but is easily confused with *P. ignava* and *P. idonea.* From the latter two species it is best distinguished by the shape of the parameres which are considerably different, possessing broad, proximally-directed lobes beneath at their base. Unlike all other species of the group, the apices of the parameres are well separated, not enclosing the distal opening.

Range: (fig. 13) Known only from the Big Bend region of western Texas from the Rio Grande north to Alpine. It coexists with *P. ignava* at all known stations.

Habitat: Taken in ravines and riparian areas along the Rio Grande, at desert springs, and in disturbed areas (the campus of Sul Ross St. Univ.). Known localities range in elevation from 2,400 ft. (ca. 730 m) to 4,480 ft. (ca. 1,370 m). We have no food plant data.

Flight period (collections per month): June (3), July (1).

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LITERATURE CITED

Butler, G. D. and F. G. Werner. 1961. The distribution and host plants of May beetles in Arizona. Arizona Agric. Exp. Sta. Tech. Bull. no. 147, 19 pp., 8 pls.

Glasgow, R. D. 1916. *Phyllophaga* Harris (*Lachnosterna* Hope): a revision of the synonymy, and one new name. Illinois St. Nat. Hist. Surv. Bull. 11:365–379.

Horn, G. H. 1887. Revision of the species of *Lachnosterna* of America north of Mexico. Trans. Am. Entomol. Soc. 14:209–295, pl. 3, figs. 1–46.

Luginbill, P. and H. R. Painter. 1953. May beetles of the United States. USDA tech. Bull. no. 1060, 102 pp., 78 pls.

Morón, M. A. 1986. El Genero *Phyllophaga* en Mexico, morfologia, distribucion y sistematica supraespecifica (Insect: Coleoptera). Inst. Ecología, Mexico D. F., 341 pp., 314 figs., 37 tbls., 9 maps.

Reinhard, H. J. 1950. The *Phyllophaga* of Texas (Scarabaeidae, Coleoptera). Kansas Entomol. Soc. 23(1):27–40, (2)41–51.

Rosander, R. W. and F. G. Werner. 1970. Larvae of some Arizona species of *Phyllophaga* (Coleoptera: Scarabaeidae). Ann. Entomol. Soc. Am. 63(4):1136–1142, 18 figs.

Sanderson, M. W. 1948. Two undescribed species of *Phyllophaga* from Texas (Coleoptera; Scarabaeidae). Occas. Pap. Mus. Zool., Ann Arbor, Michigan. no. 504, 6 pp., figs. 1a–1h.

Sanderson, M. W. 1958. Faunal affinities of Arizona *Phyllophaga,* with notes and descriptions of new species (Coleoptera, Scarabaeidae). J. Kansas Entomol. Soc. 31(2):158–173.

Sanderson, M. W. 1965. *Phyllophaga saylori,* n. sp., from Nuevo Leon, Mexico (Coleoptera: Scarabaeidae). Proc. California Acad. Sci. 31(20):559–562, 7 figs.

Smith, J. B. 1889 (1888). Notes on the species of *Lachnosterna* of temperate North America, with descriptions of new species. Proc. United States Natl. Mus. 11:481–525, pls. 48–60, figs. 1–89.

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